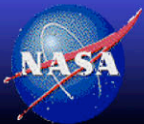


ERBS Edition 3 Nonscanner Reprocessing and Decadal Change/Trend Updates

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3rd CERES-II Science Team Meeting
Princeton, New Jersey
May 3, 2005

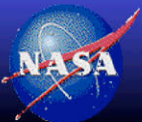


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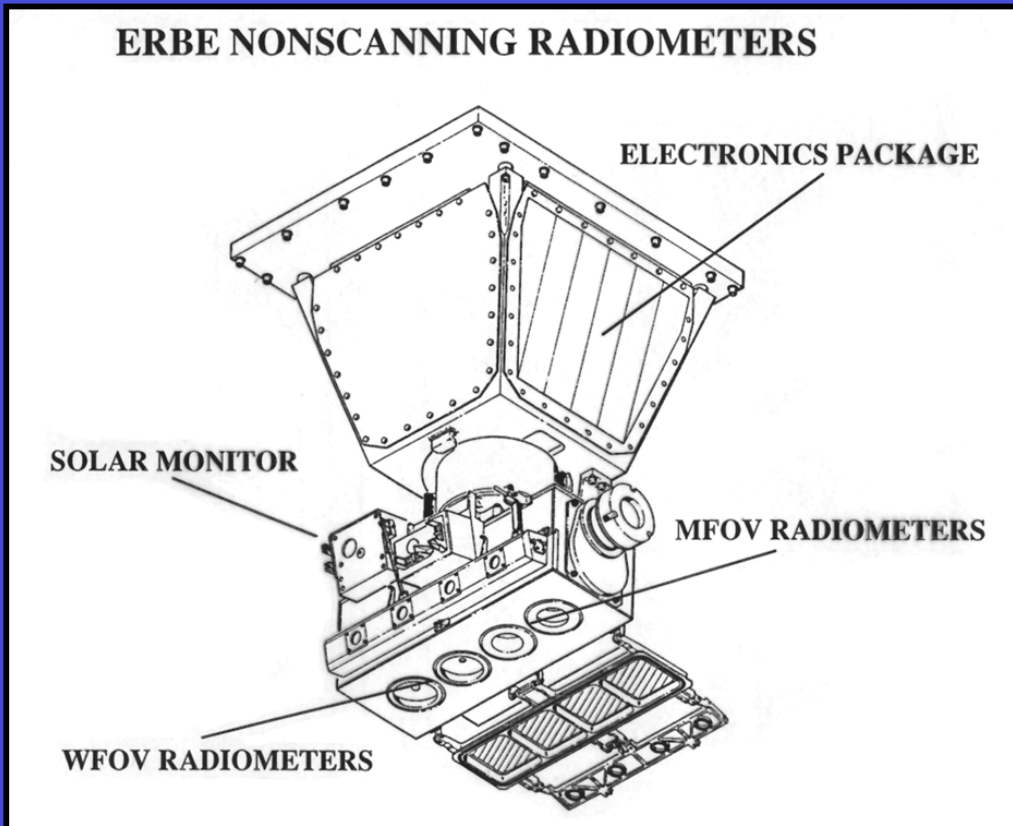


Objectives

- Highlights the key changes of the reprocessed ERBS Nonscanner Earth radiation budget data
 - ┌ Edition3 altitude correction
 - ┌ Edition3_revision1 SW drift adjustment
- Comparisons with other publicly available Earth radiation budget time series
 - ┌ HIRS Pathfinder LW, AVHRR Pathfinder ERB, ISCCP FD data
- Update values of decadal change using the new data



ERBE/ERBS Nonscanner Instrument



ERBS Satellite

Launch: 10/5/1984

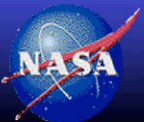
57° mid-inclined orbit

Altitude of 611 km

In orbit for over 20 yrs

Active cavity radiometers with stability design verified to 0.1%

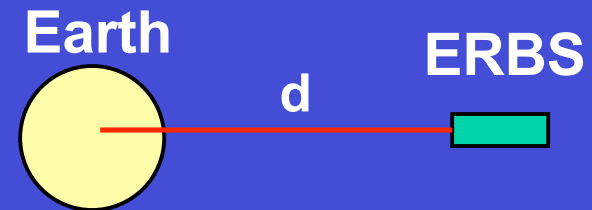
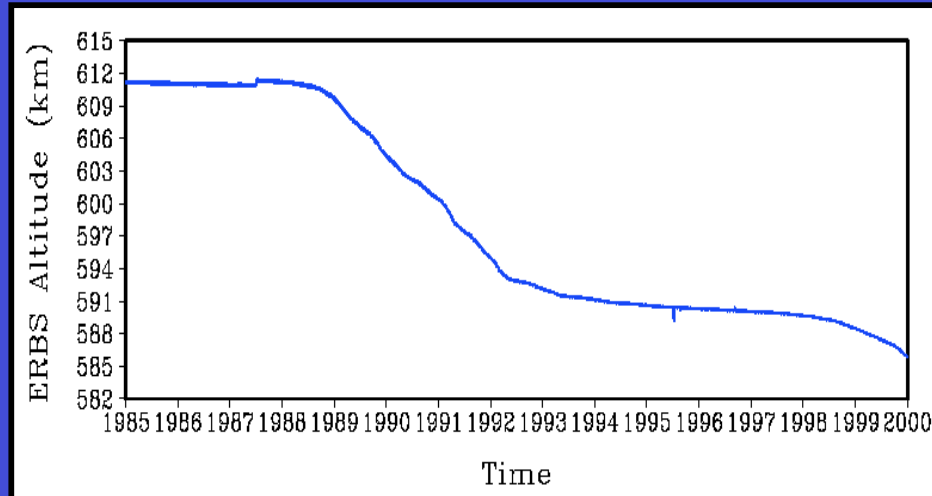
Field of view size: 500 and 1000km, Total and SW broadband channel



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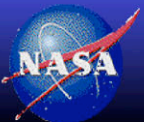


ERBS Nonscanner Edition 2 Issue



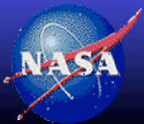
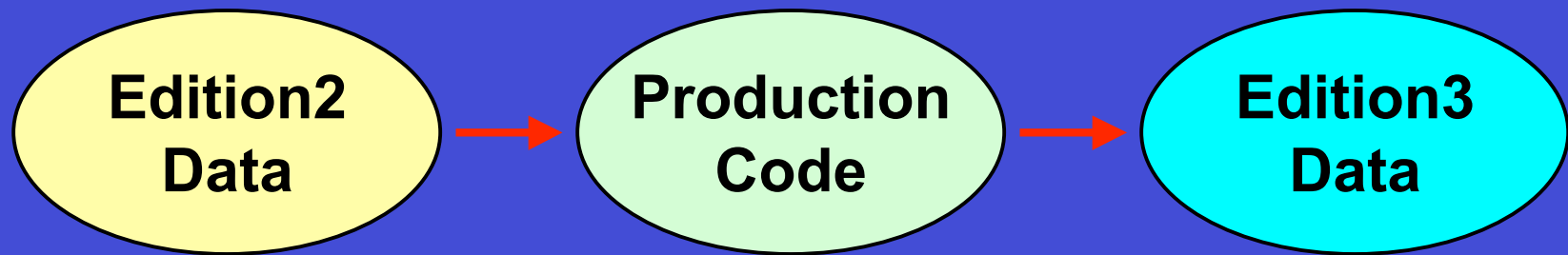
$$\text{Energy} \sim 1 / d^2$$

- ERBS altitude began to drop after 1988 due to ERBE Science Team decision to cancel satellite altitude adjustment after a near-fatal altitude maneuver
- This satellite altitude change is not included in the ERBS Nonscanner inversion algorithm
- This omission causes a small systematic increase in ERBS Nonscanner TOA fluxes over the 15-year period

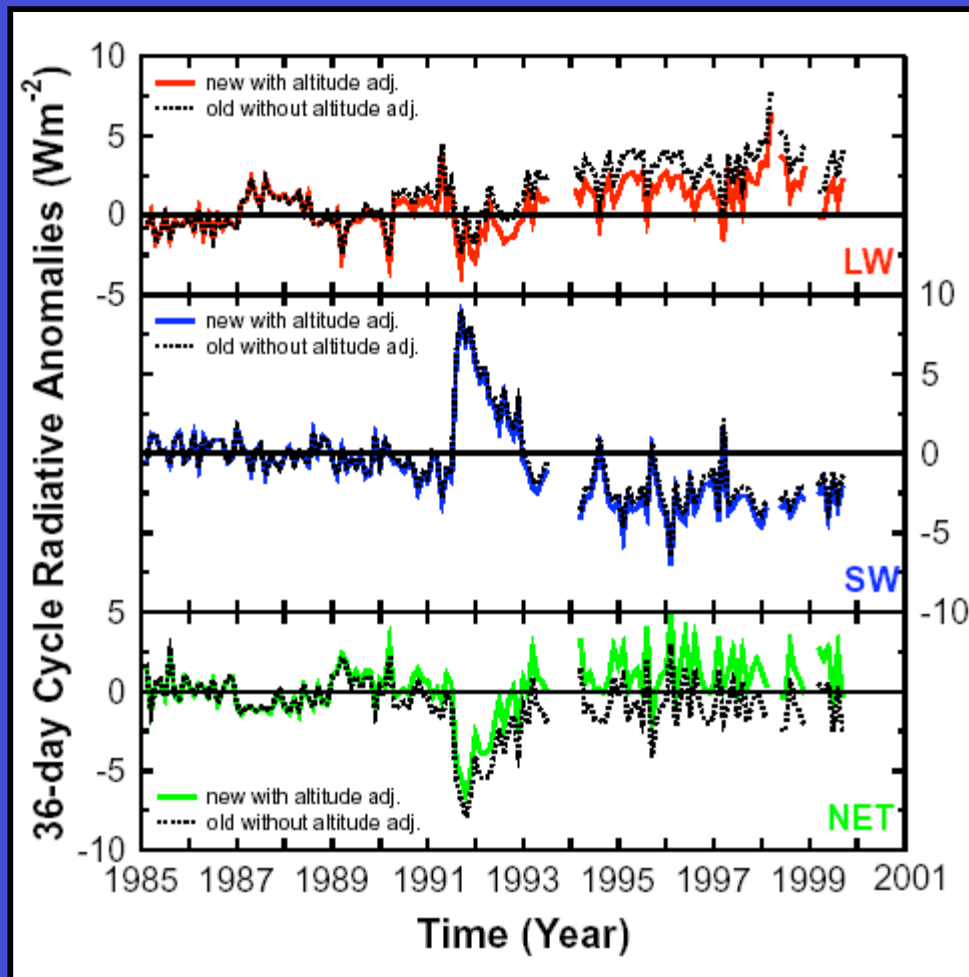


ERBS Nonscanner Edition 3 Data

- New software patch was developed and tested to account for changes in ERBS satellite altitude
- The entire ERBS Nonscanner Edition2 data has been reprocessed
- The new data will be released to the public as Edition3 dataset this month (5/2005) through the Langley DAAC



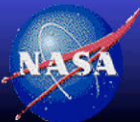
Nonscanner Edition 3: Decadal Variability



- The inclusion of ERBS altitude changes in Edition3 data will Lower the tropical mean decadal changes in the 2002 Science paper by about 1.5 Wm^{-2} in the Outgoing Longwave and 0.6 Wm^{-2} in the Reflected Shortwave Fluxes

OLR: $3.1 \diamond 1.6 \text{ Wm}^{-2}$

RSW: $-2.5 \diamond -3.1 \text{ Wm}^{-2}$

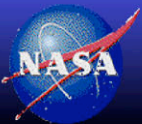
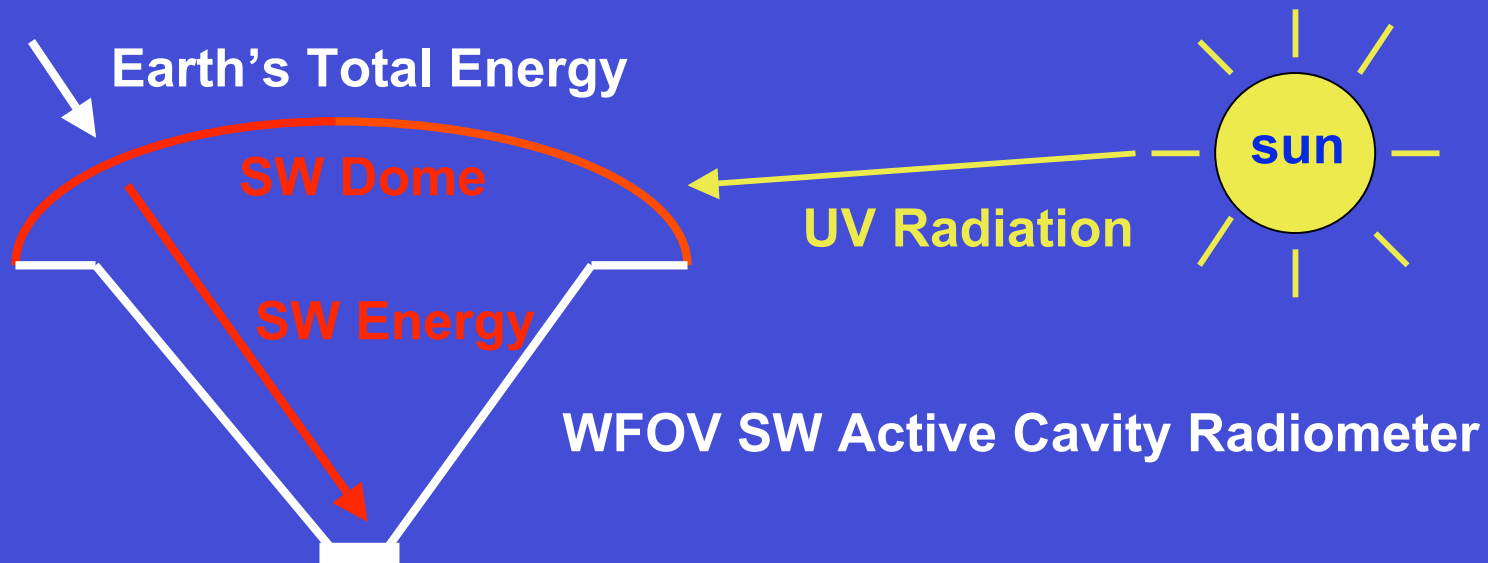


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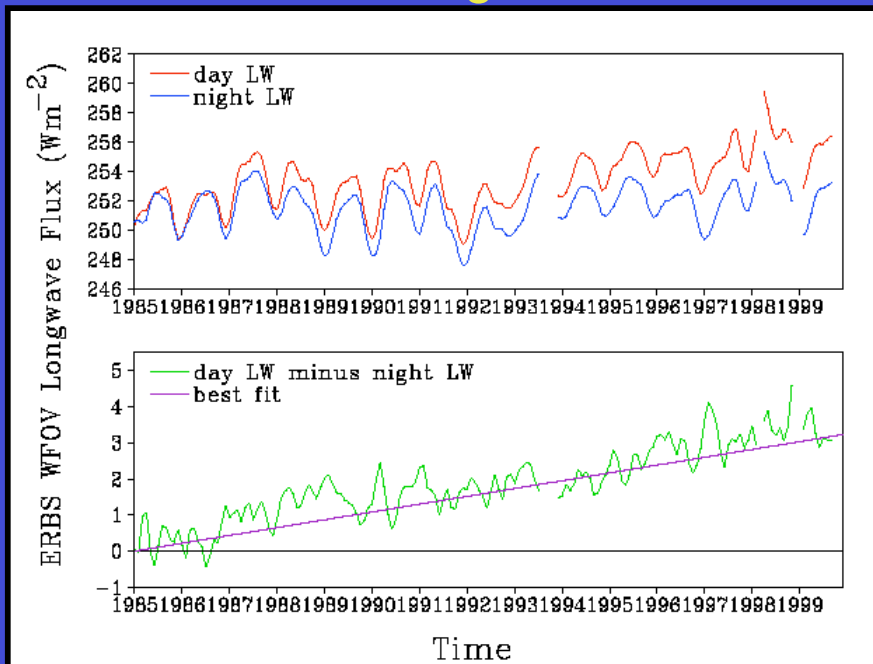
ERBS Nonscanner Edition 3 Issue

- ERBS Nonscanner Edition 3 data contains a small SW drift ($\sim 1\%$ over the 15-year period) that has not been corrected by instrument calibration
- Causes by WFOV SW dome degradation from non-uniform exposure to ultraviolet solar radiation during spacecraft sunrise and sunset

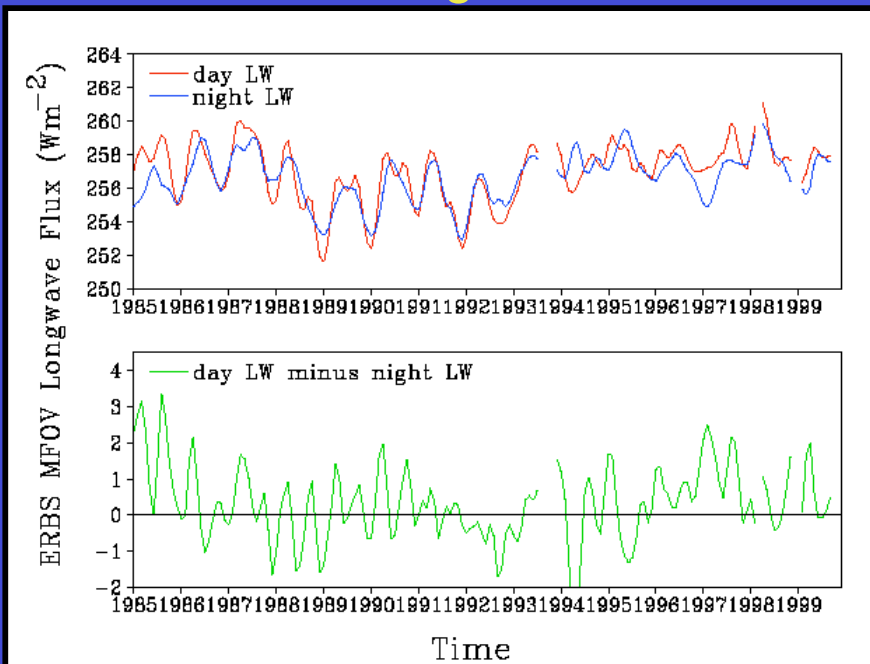


Evidences of WFOV SW Dome Degradation

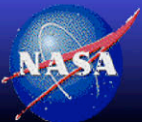
WFOV Longwave Flux



MFOV Longwave Flux

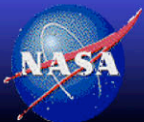
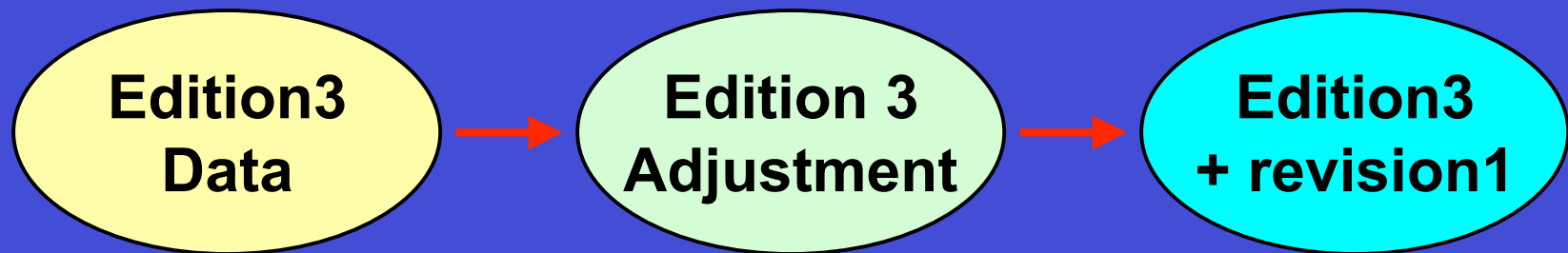


- WFOV day-night LW differences show positive linear trend over the 15-year period, indicating daytime LW is getting higher while daytime SW is getting lower ($\text{LW} = \text{Total-SW}$)
- MFOV SW dome does not expose to sunlight \diamond SW stable, Day-night LW differences show no trend

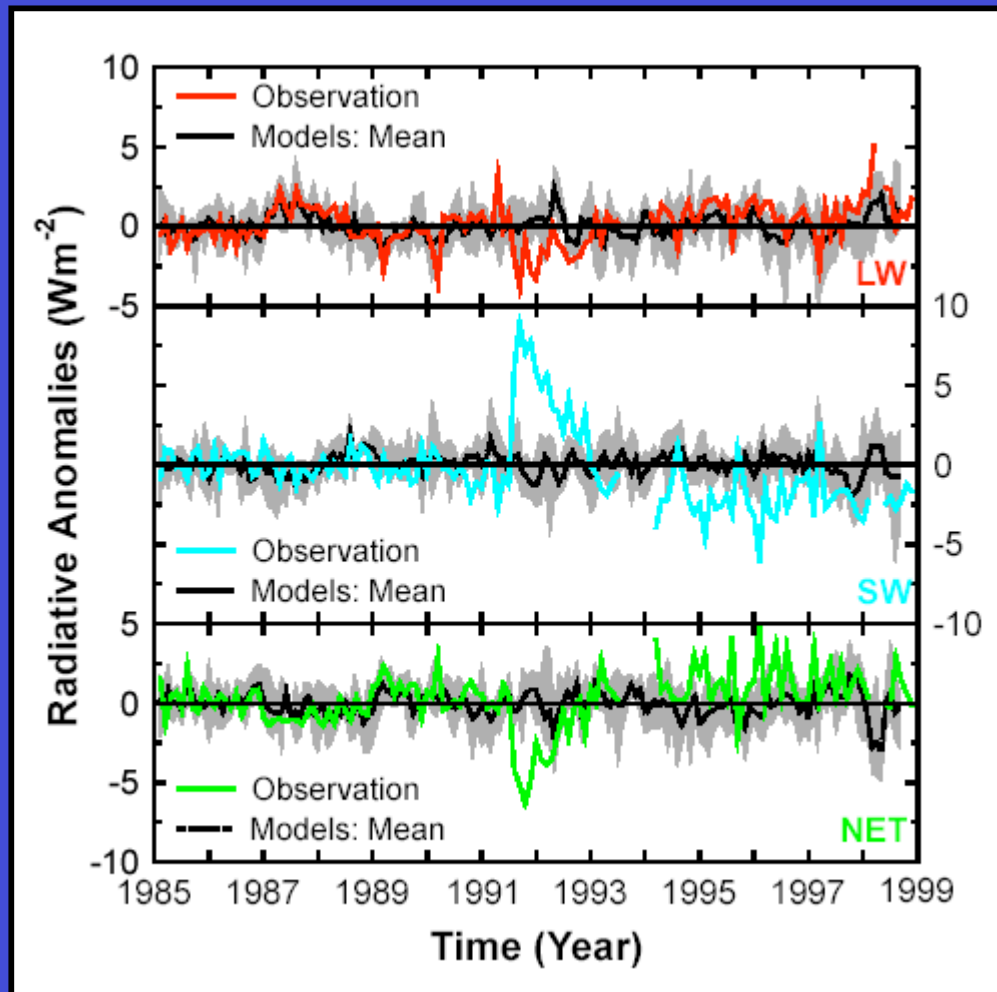


ERBS Nonscanner Edition 3 Adjustment

- A set of adjustment has been developed using time series of Edition3 day-night Longwave differences to corrected for the small SW instrument drift
- Edition 3 data at the Langley DAAC will not be reprocessed to correct for the small SW instrument drift (lack of reprocessing \$\$\$)
- The adjustment will be make available to the public through the Edition 3 data quality summary. The adjusted data will be called the Edition3+revision1 (e.g. Ed3_rev1)



Nonscanner Ed3_rev1: Decadal Variability



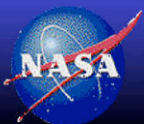
Decadal changes from Ed3 to Ed3_rev1 are

OLR: $1.6 \diamond 0.6 \text{ Wm}^{-2}$

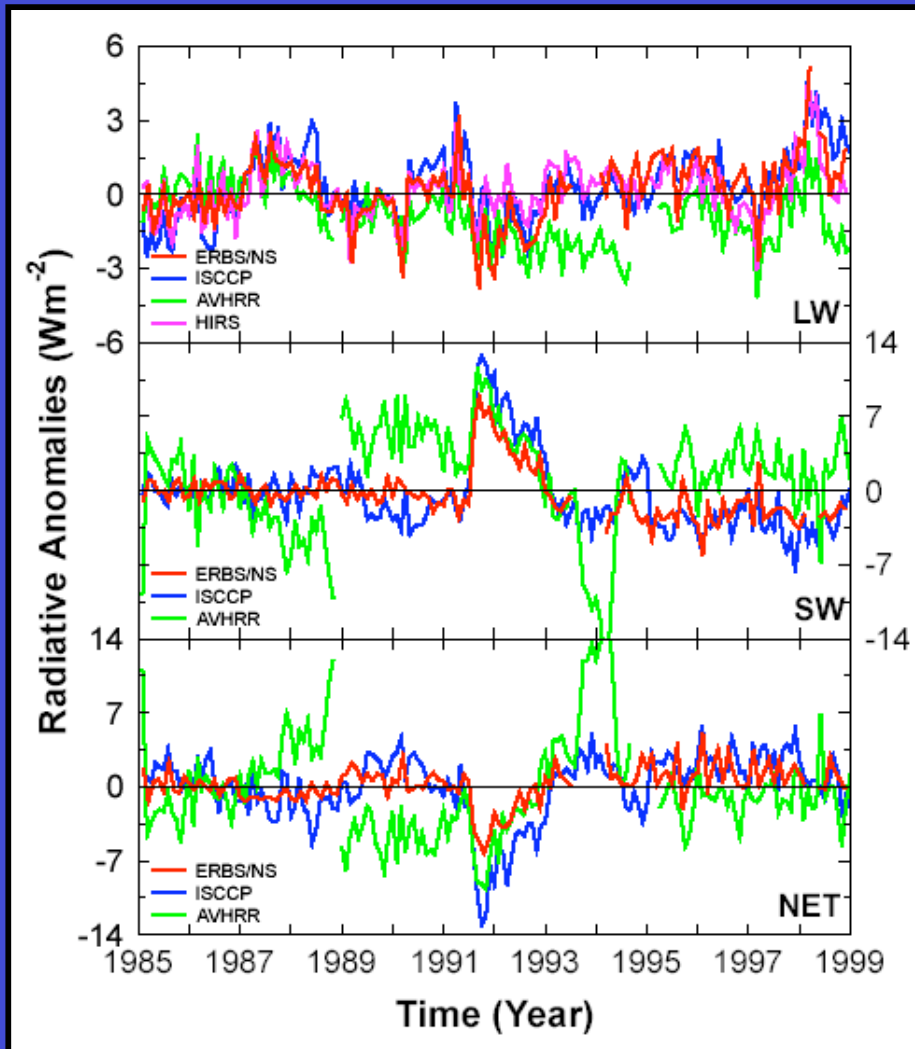
RSW: $-3.1 \diamond -2.1 \text{ Wm}^{-2}$

The new Ed3_rev1 longwave flux anomaly time series now agrees within the range of model simulations

Models and Ed3_rev1 still disagree with decadal changes in shortwave and net fluxes



Climate Data Records Comparison

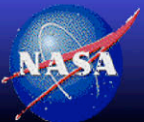


NS Ed3_rev1 compares well with HIRS LW, ISCCP FD (LW, SW, Net)

Decadal features are consistent between NS Ed3_rev1, HIRS LW and ISCCP FD datasets

AVHRR Pathfinder ERB dataset has problems with discontinuities between satellites and slow drift in local sampling time

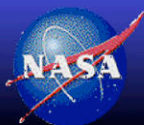
AVHRR Pathfinder ERB compares poorly with other three datasets



Tropical Mean Decadal Changes (Wm^{-2})*

Data Source	TOA LW	TOA SW	TOA Net
ERBS Ed2	3.1	-2.5	-0.6
ERBS Ed3	1.6	-3.1	1.5
ERBS Ed3_rev1	0.6	-2.1	1.5
HIRS Pathfinder	0.2	N/A	N/A
AVHRR Pathfinder	-1.4	0.7	0.7
ISCCP FD	0.5	-2.4	1.8

* Time: 94 to 97 mean – 85 to 89 mean, Space: 20N to 20S mean

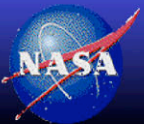


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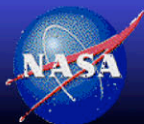


Summary

- ERBS Nonscanner Ed3 will be released shortly at the Langley DAAC and contains satellite altitude correction to the Ed2 data
- ERBS Nonscanner Ed3_rev1 contains additional SW drift adjustment to the Ed3 data and requires user modification to the Ed3 data; adjustment will be given in Ed3 data quality summary
- The new revised Ed3_rev1 ERBS Nonscanner time series lower the absolute magnitude of the reported decadal changes in longwave and shortwave fluxes (LW: 3.1 to 0.6 Wm^{-2} ; SW: -2.5 to -2.1 Wm^{-2}); the revised net flux change is now at 1.5 Wm^{-2} ; up from -0.6 Wm^{-2} from Edition2
- The observed decadal longwave changes now agree with the range of model simulations; but shortwave and net still disagree
- ERBS Nonscanner Ed3_rev1, HIRS Pathfinder longwave, ISCCP FD anomaly time series agree surprisingly well with each others; AVHRR Pathfinder however has technical problems



The End

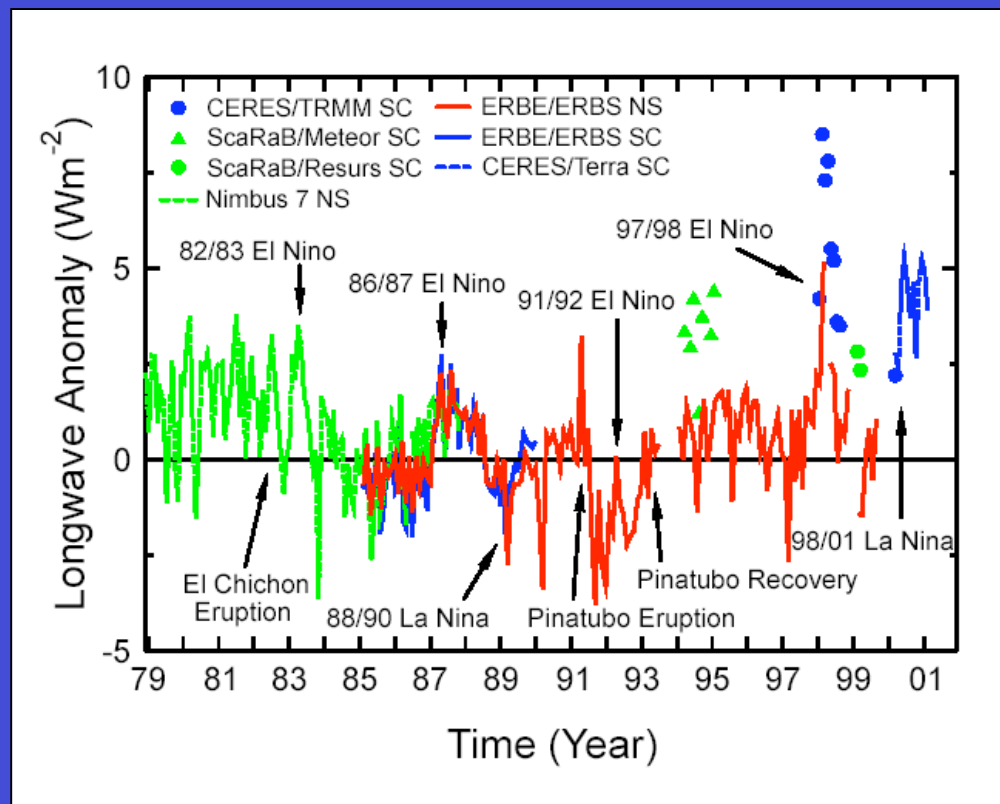


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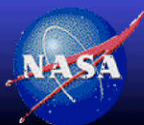
Climate Requirement: Long-term Inter-mission Calibration

ERBS Nonscanner vs. Other Missions



The highly stable ERBS single Nonscanner instrument mission overlaps with other scientific missions (past and current) over the last 20 years

ERBS Nonscanner can serve as tie to various past and future missions
Differences among sensors are within absolute calibration uncertainties



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